THE CRUSHED STONE JOURNAL

Official Publication
The National Crushed Stone Association

In This Issue—

MAY, 1930

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An Investigation of the Effect of Flat and Elongated Pieces in Crushed Stone Used As An Aggregate in Concrete Pavements

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OF late years there has been a tendency to make specification requirements more definite than hitherto. Numerical limits have been written which have not in all cases been based on definite information but rather on a feeling that at least some limitation should be set, which would make the stone entirely suitable for use. Specification limits thus arrived at are apt to err far on the side of safety. The requirement of not more than 5 per cent for flat and elongated pieces seems not to have been based on definite experimental data and as this requirement excludes from use crushed stone from a number of quarries which have given satisfactory results it seemed advisable to obtain information on the real effect of flat and elongated pieces on the quality of pavement concrete.

Figure 1—General Appearance of Stone Used

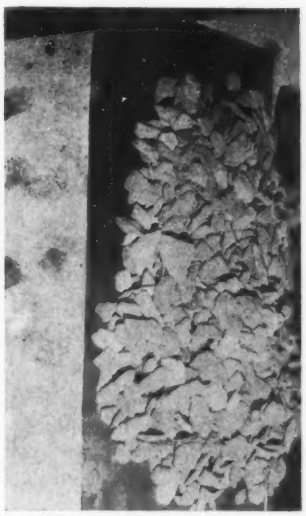


Figure 2—Appearance of Flat Pieces

Flat fragments are ordinarily defined as those whose length exceeds 5 times their least average dimension. One of the alleged bad effects of aggregate containing fragments such as these is that these fragments make for difficulty in finishing the concrete because of their tearing effect on the surface during the finishing operations. It is also felt that because of the flat fragments a somewhat higher percentage of voids may result and a somewhat higher water content may be necessary to obtain concrete of the desired consistency. One of the fears also is that such flat pieces will naturally lie in a horizontal position on the surface of the concrete after the finishing operation and that this might lead to the formation of holes in the surface due to the action of traffic in breaking the thin pieces. Ordinarily, it is considered that only the larger size flat pieces, those retained on a 1¼ inch round opening screen, are harmful so far as the finishing operation is concerned.

Objects of Present Investigations

The present investigations are designed to answer the following questions:

1. Are flat pieces actually harmful in the finishing operation?
2. What effect do flat pieces have on the strength of the concrete?

The question of the possible deleterious effects of flat pieces at the surface of the pavement under the action of traffic does not seem possible of answer through laboratory experiment and this information must be obtained through observation of roads which have long been in service. The first two questions, however, can be investigated in the laboratory and the present tests should give at least a partial answer.

Figure 3—Slab A-1:2:4 *with* 10 *Per Cent Lime, O Per Cent Flat Pieces, First Passage of Screed.*

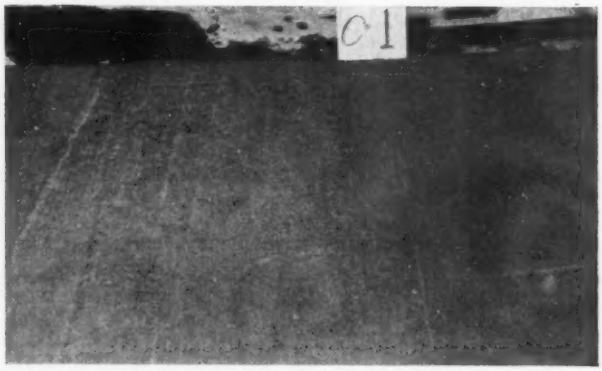


Figure 5—Slab C-1:2:4 *with* 10 *Per Cent Lime,* 10 *Per Cent Flat Pieces, First Passage of Screed.*

Preparation of the Coarse Aggregate

For the present investigations five tons of fine grained gneiss containing flat and elongated pieces was first separated by means of a square mesh vibrating screen into the sizes expressed in terms of round openings as shown in Table I.

As the material was passed over the 1-inch square mesh screen, which corresponds closely to a 1¼ inch round opening, all flat pieces above this size were removed by hand. The stone was then re-combined in accordance with the three gradations. No. 1 is a "straight line gradation." No. 2 represents the stone as received. No. 3 is a gradation having a small percentage of fine particles.

It was decided to use this stone with 0, 5, 10 and 15 per cent of flat pieces. In those mixtures containing flat pieces a given weight of flat pieces was substituted for a like weight of more cubical material retained on a 1-inch square opening screen. The weight per cubic foot and percentage of voids of the various materials used in the tests were as given in Table II.

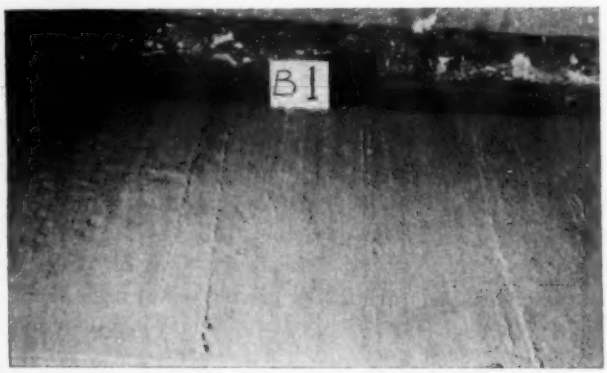


Figure 4—Slab B-1:2:4 *with* 10 *Per Cent Lime,* 5 *Per Cent Flat Pieces, First Passage of Screed.*

Characteristics of the Sand Used

The sand for this investigation was Potomac River concrete sand having the following mechanical analysis:

	Per cent
Total retained on No. 4	1
Total retained on No. 8	8
Total retained on No. 16	21
Total retained on No. 30	43
Total retained on No. 50	84
Total retained on No. 100	98

The cement was carefully blended from a number of bags of the same brand.

Mixing the Concrete

All mixing was performed in a small concrete mixer of the open, tilting-drum type. In view of the dry consistency of the batch and the fact that such mixers are more suitable for wet mixes, it was necessary to mix the concrete several minutes instead of the usual one minute.

Table I.—Gradations of Stone Used (Round openings)

		No. 1	No. 2	No. 3
Total Passing.....	2¼ inch	100%	100%	100%
Total Passing.....	1½ inch	72%	82%	79%
Total Passing.....	¾ inch	30%	27%	14%
Total Passing.....	¼ inch	2%	1%	0%

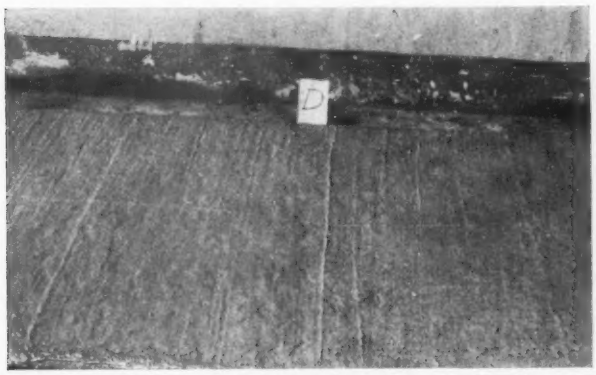


Figure 6—Slab D-1:2:3½, *0 Per Cent Flat Pieces, First Passage of Screed.*

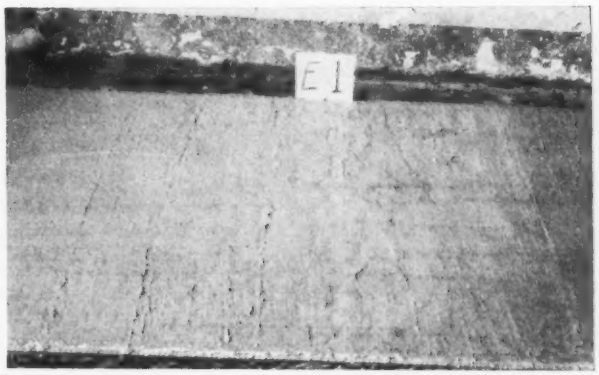


Figure 7—Slab E-1:2:3½, *5 Per Cent Flat Pieces, First Passage of Screed.*

Concrete Specimens

For the purpose of obtaining some idea of the difficulty of finishing and at the same time to obtain specimens that would be suitable for subsequent strength tests, slabs 3 feet wide, 6 feet long and 6 inches thick were made. The slab molds were placed on tar paper and they were sub-divided by means of partitions three inches high and so arranged that the slab could subsequently be broken into six beams, 3 feet long, 12 inches wide and 6 inches thick. Four batches were required to fill each slab and the finishing operation was performed by the use of a 12-inch steel channel section of such a weight that the weight on the concrete was 25 pounds per lineal foot. As nearly as possible concrete was deposited in the mold and subjected to working and finishing such as would obtain in the normal road finishing operation. It was decided that the best criterion of the difficulty of finishing would be the appearance of the concrete after each successive passage of the steel screed and, finally, after the use of a wood float. The consistency, as nearly as practicable, was the same in all cases and closely approached a slump of 1½ inches.

Photographs were taken after the first and second passage of the steel screed and after a single passage of the wood float. Similar photographs were taken of all of the slabs made. One slab was made for each mixture as shown in Table III.

Lime was used in the 1:2:4 mixes because it is required by the particular specification under which the test sample of stone was investigated. The 1:2:3½ mix was used in order to get general information applicable to the majority of the States where this mixture is generally used.

The accompanying figures, (9, 10 and 11) show the appearance of the surface after each of the three finishing operations and are otherwise so labeled as to need no further description.

Table II—Weights Per Cu. Ft. and Per Cent Voids (Dry and Loose)

		Weight per Cu. Ft.	Per Cent Voids
Cement		94	
Lime		40	
Sand		94.7	42.5
Stone	Gradation No. 1, 0 Per cent flats	95.1	47.2
	Gradation No. 1, 5 Per cent flats	94.3	47.6
	Gradation No. 1, 10 Per cent flats	92.5	48.6
	Gradation No. 1, 15 Per cent flats	92.7	48.3
	Gradation No. 2, 5.5 Per cent flats	87.7	51.3
	Gradation No. 3, 0 Per cent flats	88.7	50.8

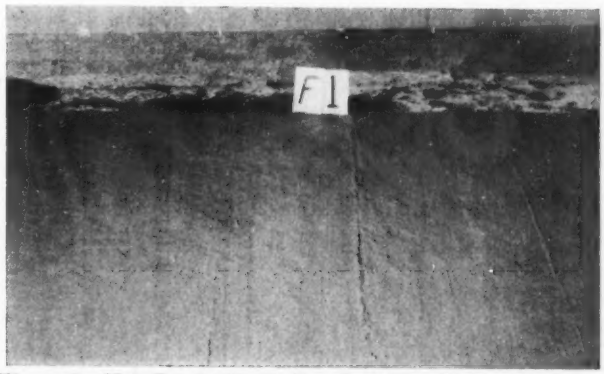


Figure 8—Slab F-1:2:3½, *10 Per Cent Flat Pieces, First Passage of Screed.*

Figure 9—Slab G-1:2:3½, 15 Per Cent Flat Pieces, First Passage of Screed

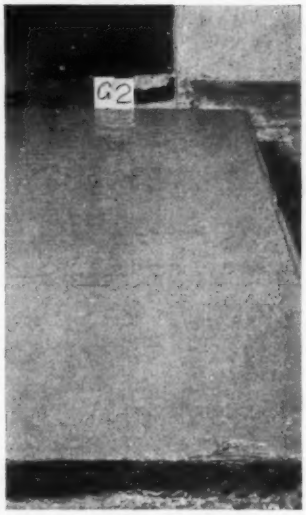


Figure 10—Slab G—Second Passage of Screed.

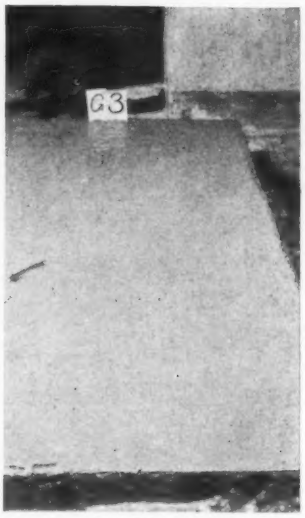


Figure 11—Slab G—After Use of Wood Float.

Table III—Slab Mixes

Slab No.	Proportions Dry, loose volume	Stone Gradation	Per Cent Flat Pieces	Weights of Materials Per Batch in Pounds					Bags Cement Per Cu. Yd	W/C
				Cement	Sand	Stone	Lime	Water		
A	1:2:4 +10% lime	1	0	47	94.7	190.2	2.0	27.5	5.8	0.88
B	1:2:4 +10% lime	1	5	47	94.7	188.6	2.0	27.4	5.8	0.88
C	1:2:4 +10% lime	1	10	47	94.7	185.0	2.0	27.4	5.9	0.88
D	1:2:3½	1	0	53.7	108.3	190.2	.....	28.9	6.3	0.81
E	1:2:3½	1	5	53.7	108.3	188.6	.....	28.9	6.4	0.81
F	1:2:3½	1	10	53.7	108.3	185.0	.....	28.9	6.3	0.81
G	1:2:3½	1	15	53.7	108.3	185.4	.....	28.9	6.4	0.81
H	1:2:4 +10% lime	2	5.5	53.7	108.3	175.4	2.0	26.8	6.1	0.86
K	1:2:4 +10% lime	3	0	47	94.7	190.2	2.0	26.3	5.9	0.84

Discussion of the Test Results

Referring first to slabs A, B and C it will be noted from the photographs that these slabs were all finished with little difficulty. Slab A having zero per cent of flat pieces shows the worst appearing surface after the first passage of the screed but this was due to the fact that this was the first slab made and the concrete was not kept heaped sufficiently in advance of the screed. The hole noted in the surface occurs at the end of one of the batches. The screed should have been stopped sooner so as to allow more concrete to be heaped in front of it.

It will be noted that slabs B and C, having 5 and 10 per cent of flat pieces respectively, show an abundance of mortar after the first passage of the screed and there was no difficulty with stone pockets whatever, nor was there any difficulty noticed due to the possible effect of flat pieces tearing the surface during the finishing operation. This effect was not noticed in any of the slabs.

Slab H made with the stone graded as received and containing 5.5 per cent of flat pieces, 1:2:4 + 10 per cent lime mixture was screeded with difficulty. This is evidenced by the photographs. The ridges of mortar noticeable after the first screeding are due to the slight backward motion of the screed which the operators used unconsciously in their efforts to move the screed along. At one spot there was so much excess stone that the screed rode up about ½ inch and on the second screeding, when this spot was cut down to the proper level a hole resulted in the surface as shown in photograph labeled H2 (Fig. 13). That this effect was due to bad gradation is indicated by a comparison with slabs B and C which contained 5 per cent and 10 per cent of flats but with well graded stone. These slabs gave no trouble whatever in finishing.

Referring to the data in Table II it will be seen that the percentage of voids in the stone having 0 per cent

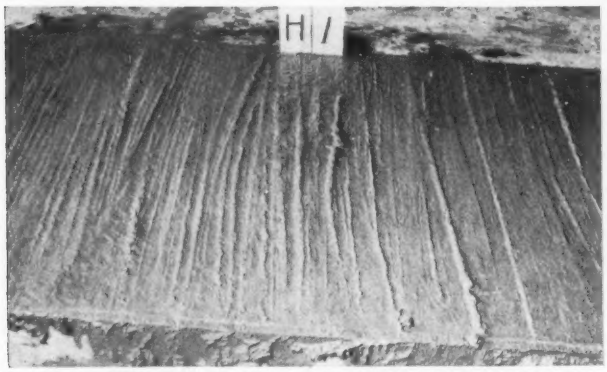


Figure 12—Slab H-1:2:4 with 10 Per Cent Lime, 5.5 Per Cent Flat Pieces, Poor Gradation, First Passage of Screed.

Figure 13—Slab H—End View—Note Hole in Surface.

"flats" was 47.2; with 5 per cent "flats" it was 47.6, and with 10 per cent "flats" it was 48.6. There is a tendency for the flat pieces to slightly increase the percentage of voids.

In Table IV are shown the calculated solid volumes of materials used per batch and also the ratio of volume of mortar to volume of voids in the stone. It will be noted that the ratio of volume of mortar to volume of voids is affected by the percentage of voids in the stone and that it is 1.34 for 0 per cent "flats" and 1.30 for 10 per cent "flats." On the other hand, it will be noted that the percentage of voids in the poorly graded stone used in slab H was 51.5 per cent and that the ratio of volume of mortar to volume of voids in this mixture was only 1.22 per cent and only 1.15 for mixture K. It is thus perfectly evident that the effect of a comparatively high percentage of flat pieces in increasing the percentage of voids and in decreasing the ratio of volume of mortar to volume of voids is small as compared with the effect of poor gradation.

The poorly graded stone, having a high percentage of voids, produces concrete having a very low ratio of volume of mortar to volume of voids. The effect of this condition is clearly shown in the photograph of slab K (Fig. 14) in which will be noticed a piling up in front of the screed, of excess stone unsurrounded with mortar.

Referring to slabs D, E, F and G (Figs. 6, 7, 8 and 9) made with a 1:2:3½ mixture and with 0, 5, 10 and 15 per cent of "flats" respectively, as is perfectly evident from the photographs, there was no difficulty whatever in the finishing operation. There was an abundance of mortar and there was no tearing action due to the presence of the flat pieces. It will be noticed in Table IV that the ratio of volume of mortar

Table IV—Calculated Solid Volumes of Materials Used per Batch

Mixtures	A	B	C	D	E	F	G	H	K
Cement	0.241	0.241	0.241	0.276	0.276	0.276	0.276	0.241	0.241
Sand	0.566	0.566	0.566	0.648	0.648	0.648	0.648	0.566	0.566
Lime	0.020	0.020	0.020	.....	.....	.....	.....	0.020	0.020
Water	0.440	0.440	0.440	0.464	0.464	0.464	0.464	0.430	0.421
Vol. of Mortar	1.267	1.267	1.267	1.388	1.388	1.388	1.388	1.257	1.248
Stone	1.058	1.049	1.028	1.058	1.049	1.028	1.029	0.974	1.058
Concrete	2.325	2.316	2.295	2.446	2.437	2.416	2.417	2.231	2.306
Vol. of Voids in Stone Used in Batch	0.942	0.951	0.972	0.942	0.951	0.972	0.971	1.026	1.084
Ratio of Vol. of Mortar to Vol. of Voids in Stone	1.34	1.33	1.30	1.47	1.46	1.43	1.43	1.22	1.15

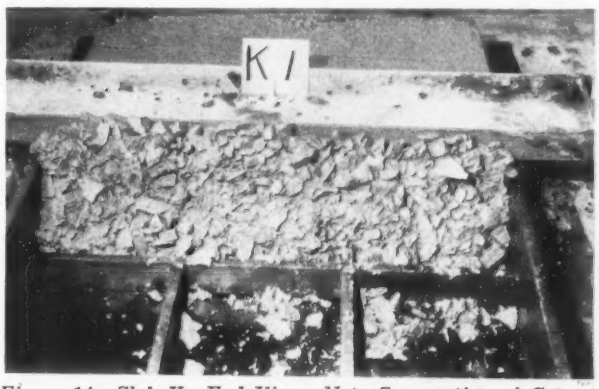


Figure 14—Slab K—End View—Note Segregation of Course Aggregate.

Figure 15—First Screeding.

Figure 17—Third and Final Screening with Wood Float.

to volume of voids was decreased only slightly from 1.47 to 1.43, due to the presence of 15 per cent of flat pieces and in all cases this ratio was relatively high.

In the 1:2:4 mixes, especially with gradation H and K, the mortar voids ratio becomes quite small and a stony mix results. This condition might readily obtain as a result of several factors:

(a) Poor gradation of stone.
(b) Segregation of well-graded stone.
(c) Insufficient weight of sand due to the bulking effect of moisture.

(a) Poor Gradation of Stone

The specifications require that the weight of stone be determined by loose measurement in a cubic foot measure and that that weight be used for purposes of concrete proportioning. If the stone is well graded when the determination is made a high weight results and if, subsequently, the stone becomes poorly graded a low mortar void ratio results. This is well illustrated by a comparison of B and K. (Table IV.)

Figure 16—Second Screeding.

(b) Segregation of Stone

Conical stockpiling is certain to lead to segregation and the disparity in workability would be even more pronounced than in the cases of B and K. Even K, which is a "stony" mix was finished without much difficulty. Had there been a much lower percentage of mortar, however, this would not have been true.

(c) Insufficient Weight of Sand Due to the Bulking Effect of Moisture

Sand which has one per cent of moisture may look dry and yet may be bulked as much as 10 per cent and if the sand is slightly damp a very big error in weight per cubic foot results. The effect is that too little sand is used in the mix and there is a lack of workability. Fine sands "bulk" much more than coarse sands and may cause harsh working concrete if the bulking effect is not completely taken into account.

As a result of the preliminary work in the manufacture of the slabs a few conclusions seem warranted.

Conclusions

1. The presence of up to 10 per cent of flat pieces in the stone has no noticeable effect on the difficulty of finishing 1:2:4 concrete, provided that same stone with the flat pieces removed produces concrete which may be finished without difficulty.

2. The presence of flat pieces only slightly increases the percentage of voids in the stone and requires no change in water-ratio to produce concrete of the same consistency as obtained with stone having zero per cent of flat pieces.

3. Changes in gradation in stone have a far greater effect on percentage of voids and mortar voids ratio than flat pieces.

4. The 1:2:3½ mixes were more workable than the 1:2:4 mixes. They have a much greater factor of

Figure 18—Cutting Surface to Facilitate Breaking.

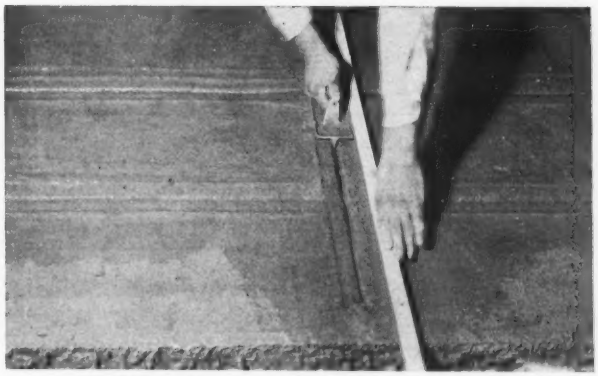


Figure 19—Finishing Joints in Surface.

safety against variables which may occur in the aggregates than the 1:2:4 mixes.

Strength Tests

The preparation and characteristics of the test slabs have already been described. These slabs were broken into beams one foot wide and three feet long one day after the concrete was placed. The resulting beams were stored in a moist room at a temperature within a few degrees of 70° F. for a period of 27 days. They were then broken as simple beams, using a 20-inch span length and subjected to a single load at the center. Each 36-inch beam was tested twice. Three of the six beams into which each slab was divided were tested with the bottom side in tension and the remaining three beams with the top finished surface in tension. This procedure was adopted to determine if there was any difference in strength due to the presence of honeycomb in the bottom of the slabs. The complete results of these tests are tabulated in Table No. V. For the sake of convenience the average results are given in Table No. VI.

Discussion of Strength Results

It will be noted that slab A which has 0% of flat pieces has a somewhat lower average modulus of rupture than the remaining slabs. This is due to the fact that one of the beams was particularly low in strength. Slab A was the first slab of the series and it required a little practice to determine the right amount of manipulation to give the concrete after placing it in the forms to simulate the placing of a concrete road slab. Not as much work was put into the placing of the first batch of concrete used at the beginning of the slab as was the case later on. This probably accounts for the comparatively low results in one of the beams.

It will be noted that these low results occur when the bottom side of the beam was placed in tension and this suggests excessive honeycombing such as results when insufficient work is performed on the concrete to settle it into place. If these two low results are omitted from the average and the average is based on ten breaks instead of 12 breaks, the final average, 740 lbs., thus obtained more nearly approaches the average of the remaining slabs in the 1:2:4 series.

As would be expected the 1:2:3½ concrete gives somewhat higher values for modulus of rupture than the 1:2:4 concrete and the ratio of the strengths obtained is almost directly in the same relation as the cement contents per cubic yard.

In Table III, it has been shown that no change in water ratio is necessary because of the presence of flat pieces and consequently it would be expect-

Figure 20—Bottom of Beam From Slab A. Zero Per Cent Flat Pieces. Particularly Bad Honeycombing Due to Insufficient Manipulation.

Table V—Transverse Test—28 Days

1:2:4 + 10% Lime

Slab	Bottom in Tension		Top in Tension		Average
	Load	Modulus of Rupture	Load	Modulus of Rupture	(nearest 10 lbs.)
A	8000	(556)*	10890	755	
0% Flats	8780	(610)*	10670	740	
Stone					
Gradation	10990	763	10750	746	
No. 1	10100	702	9680	672	
	10410	724	11890	825	
	10150	705	11360	788	
		Ave. 720		750	740 Ave.
		(4 breaks)			(10 breaks)
B	11230	781	9990	694	
5% Flats	11560	802	11400	792	
Stone					
Gradation	9880	686	10150	705	
No. 1	11390	790	11240	781	
	10800	750	11030	767	
	10350	719	11900	826	
		Ave. 750		760	760 Ave.
C	11780	818	10800	750	
10% Flats	9860	685	10100	701	
Stone					
Gradation	12490	867	9780	679	
No. 1	10620	738	11290	784	
	10280	714	10350	719	
	11940	830	10900	757	
		Ave. 780		730	760 Ave.
H	12210	848	10620	737	
5.5% Flats	12050	836	9250	643	
Stone					
Gradation	11160	774	10350	718	
No. 2	12620	876	10320	716	
	12280	852	9800	681	
	10660	739	9300	646	
		Ave. 820		690	Ave. 760
K	11200	778	10140	705	
0% Flats	12250	851	11160	775	
Stone					
Gradation	11280	783	10750	746	
No. 3	12260	851	11680	810	
	9160	637	11000	764	
	11220	780	10800	750	
		Ave. 780		760	Ave. 770

Note: *The first beam in slab A is evidently defective and results are omitted from the average.
Slab C showed the least honeycombing.

1:2:3½ Stone Gradation No. 1

Slab	Bottom in Tension		Top in Tension		Average
	Load	Modulus of Rupture	Load	Modulus of Rupture	(nearest 10 lbs.)
D	11890	825	11750	816	
0% Flats	12730	885	10300	715	
	10600	736	10520	731	
	12790	888	12060	836	
	13120	911	11020	765	
	12550	871	11060	767	
		Ave. 850		770	Ave. 810
E	12420	864	11470	795	
5% Flats	10750	746	11360	788	
	9900	688	11070	767	
	12020	835	11990	832	
	11720	814	10850	754	
	10790	749	11850	823	
		Ave. 780		790	Ave. 790
F	11840	823	14650	1018	
10% Flats	11720	815	10500	729	
	10700	743	11330	787	
	13110	910	11600	806	
	12120	842	11900	826	
	13130	913	12080	838	
		Ave. 840		830	Ave. 840
G	12390	860	12420	863	
15% Flats	11940	830	10620	738	
	10760	746	11270	782	
	10200	708	12120	842	
	9990	694	12550	871	
	12560	871	11850	823	
		Ave. 780		820	Ave. 800

Table VI. Average Values for Modulus of Rupture—28 Days

1:2:4 + 10% Lime

Slab	Stone Gradation	% Flats	Modulus Of Rupture
A	1	0	740
B	1	5	760
C	1	10	760
H	2	5.5	760
K	3	0	770

760 = Ave. Modulus of Rupture of all 1:2:4 beams.

1:2:3½ mixture

D	1	0	810
E	1	5	790
F	1	10	840
G	1	15	800

810 = Ave. Modulus of Rupture of all 1:2:3½ beams.

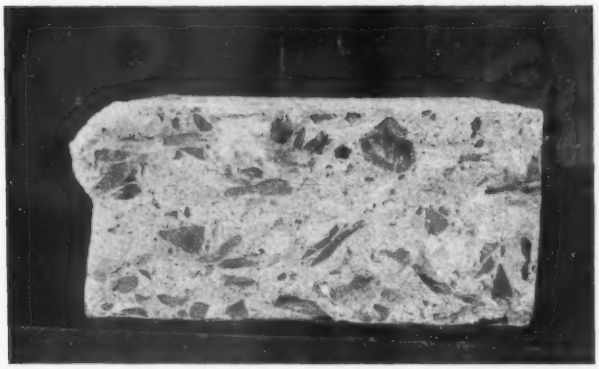


Figure 21—1:2:4 *with* 10 *Per Cent Lime,* 10 *Per Cent Flat Pieces, Showing Their Position.*

ed that the strength results, for all practical purposes, would be identical. This expectation is borne out by the test values. It may be stated that the values for modulus of rupture in the 1:2:4 and also in the 1:2:3½ mixes are not altered by the presence of flat pieces and, moreover, the strength values obtained are all uniformly high.

The presence of flat pieces up to limits used in these investigations (10% in the 1:2:4 mixes and 15% in the 1:2:3½ mixes) has no noticeable effect on the modulus of rupture of the concrete.

Appearance of Broken Beams

In Fig. 20 is shown the bottom of one of the beams of 1:2:4 mixture containing 0% flat pieces. This view well illustrates the fact that honeycombing may result in the bottom of a slab when the proportions are such that none too much mortar is present to create workability, or when insufficient work is done to settle the concrete into place. The beam shown was particularly bad and a little more work in placing the concrete would have cured this condition.

The question of the position taken by the flat fragments with respect to the surface of the slab is one which has been questioned. The accompanying photograph (Fig. 21) shows the broken cross-section of one of the beams made from slab C which contained 10% of flat and elongated pieces. It is noticeable that the flat pieces are scattered throughout the mass of the concrete and that they lie in different positions, some of them horizontal, others inclined at an angle. This photograph is quite characteristic of all of the cross-sections of the broken beams and there seems to be nothing in the appearance of the concrete which would lead one to be fearful of the effects of traffic on the surface of such a slab.

General Conclusions

The preceding detailed discussion and conclusions may be briefly summarized as follows:

1. Flat and elongated pieces to a small extent increase the percentage of voids in stone aggregate and probably to a slight extent decrease the workability of the concrete because of the resulting decrease in the ratio of volume of mortar to the volume of voids in the stone. However, a considerably greater increase in voids takes place due to variations in gradation which may produce much harsher workability than produced by flat and elongated pieces.

2. Flat pieces up to 10 per cent in the 1:2:4 mixtures and 15% in the 1:2:3½ mixtures do not decrease the strength of the concrete.

3. The indications are that the flat pieces do not lie in a position such as to cause trouble at the surface of a concrete slab.

Increased Concrete Road Construction in the British Isles

DURING last year approximately three million super yards of all-concrete road work, equivalent to 254 miles of 20 ft. carriageway, were laid in the British Isles. This figure constitutes a record for this type of construction, and shows the substantial increase of 25 per cent over last year's figure.

In the lighter trafficked areas the cement-bound road is gradually gaining interest, and approximately 164,651 super yards were laid during the year. This work has necessitated the production of at least 10,000 tons of steel, 120,000 tons of cement, 230,000 tons of sand, and 460,000 tons of broken stone. Further, for the manufacture of the cement and steel approximately 80,000 tons of coal were required.—From *Cement, Lime and Gravel,* March, 1930.

How to Remove Road Oil and Tar from Your Automobile

Here is a recipe for cleaning road oil and tar from your automobile. It may be worth clipping and tacking up on your garage wall for future reference.

Mix one quart lubricating oil with one gallon gasoline. Apply and allow about five minutes for this solution to dissolve the bituminous material. Then wash with mild soap and water. This must be done before oil or tar has hardened.

No Matter How Much You Need That Order—Stick to Your Price[1]

By A. H. Deute

General Manager, The Billings & Spencer Company

I HAVE lost orders because I would not make a confidential price concession. And I have taken business by making a confidential price.

In the long run, I have never had any lasting regrets over the business I lost because I would not make a concession. But sooner or later, I have always been sorry that I took the business on which I made a concession.

The salesman who has always been permitted to work on the basis of making a special concession under pressure of circumstances, and who has never had back of him a simon-pure policy of no private arrangements or concessions, cannot realize the genuine advantage which the one-price man working for the one-price house enjoys. And the salesman who has been held to a definite one-price policy, and that an open and published price, may now and then grumble and growl over what seems a straight-laced, unreasonable and narrow-minded plan. But if he knew both sides of the story, he'd thank his lucky stars for the hard-and-fast rule which held him in line and worked out to his great advantage.

I am not referring to the sliding scale of prices, based on quantities, provided that price scale or price list is an open and published list. There is every reason why a man who can buy a carload should enjoy a better price than the man who can merely buy a case; and every reason why the man who buys in case lots should enjoy a saving over the man who must buy in fractions of a dozen. There is no problem there. The thing with which we are concerned here is the so-called secret rebate—the confidential concession—the extra 5 or 10 per cent allowed to a "pet" customer for one reason or another—generally a fancied reason and invariably based on weakness on the part of the salesman, a weakness which is caused and created by the house back of the salesman.

A firm's price list is either an open, published list to which all buyers adhere and which the company follows, or it is a price list which really means nothing because on occasion it is broken.

Now, if the price list be broken in an open manner and a price change put into effect, there can be no fault found because every house has entire right to change its prices, either upward or downward.

If, on the other hand, a special price be made, which is a deviation from the published and generally understood price, then it is naturally made "confidentially." Naturally, it must either be an openly understood and uniform price change to which all buyers are entitled, or it is something which must be "kept under your hat" because it is not designed to be general. When it is given as a secret concession, it is obviously made in confidence so that other buyers, other customers of the firm, may be kept from knowing about it. In other words, the house is undertaking to withhold its best price from certain customers and secretly favor others.

It is plain, therefore, that a house can have no compromise plan as to price. Either it adheres to its published prices or it does not adhere to them. If the former, it can go steadily ahead, right down the middle of the road. If the latter, then it must constantly resort to subterfuge.

One of the commonest questions which buyers ask of salesmen is this: "Is anybody getting anything better than we are getting?"

Either the salesman must say, "Here is our price list. Everybody buys on this list. There are no exceptions!" or he must do one of two things. He must either admit that there are "pets," which will immediately cause difficulties, or he must lie.

Salesmen Must Have Faith

Every employer of salesmen knows that unless his men have faith in the house and its policies they cannot have that confidence and that enthusiasm which salesmen must have who are going to make good. No employer is going to get very far if he asks his men to go out and tell lies for the house.

What it amounts to is this—once start in on a policy of now and then making a special concession, and soon there is no stopping it. It spreads, as a practice, from territory to territory—from salesman to salesman.

[1] From *Printers Ink*, March 27, 1930.

It weakens the morale of the individual salesman because once he can make a confidential concession to one customer, he naturally resorts to the same tactics the next time he meets with a difficult situation.

Actually, there is no such thing as a truly confidential concession. Even though the buyer may not divulge the arrangement, it is known inside the seller's organization. And the morale of the whole company is broken thereby.

Right now we have to take a very firm hold on ourselves and make up our minds to sit tight. Orders are not easy to get. Salesmen who are working on commission are finding it doubly hard to get satisfactory commission checks. Salesmen who are working on salaries are giving the house shivers when the selling cost is figured up.

Every sales manager is striving with might and main to hold to the minimum a selling cost which has jumped up sharply. And the buyers not only know this but are taking advantage of it. Many a time the buyer is in a most trying position. His firm looks to him to find articles which can be sold at a price to bring in customers. No buyer can expect to hold his job who does not buy at the bottom of the market.

With the buyer searching for salable articles at attractive prices, salesmen are often at their wits' ends to close the sale.

A few weeks ago two salesmen of household utensils were making a fight for business. One had a nationally known and advertised line while the other's line was not advertised and had always been largely a jobbing proposition, offered on a contract basis.

Naturally, the salesman with the advertised line had much more salability to offer the buyer. But the buyer put it up to him this way: "You are asking me fully 20 per cent more than I can buy this other line for, and so far as I can see, their line is just as good as yours. I know you are going to talk about your advertising, but right now people are interested in price. And I have to give them what they want. Now, either you are going to be out of the picture and I take on the other line, or you will have to sharpen your pencil and talk turkey."

The prospective order ran into thousands of dollars. It was the first good-sized order this salesman had had in sight for weeks. The buyer finally offered him the order provided his house would allow him 10 per cent for "advertising cooperation." The salesman wired and telephoned the house. The sales manager could not be moved. Finally, the buyer said: "I don't mind telling you your line is more salable than the other one, but not to the extent of 20 per cent. Here's what I will do. I've written up the order for double the amount we discussed and made it read subject to 10 per cent advertising allowance. Take it along with you and send it in. Maybe when they see it, they'll grab it and fill it."

The buyer proved correct. When the order running into several thousand dollars was laid before the sales manager, he took it in to the president of the company before turning it down. The president had just had a long talk with his board of directors who found fault with an inventory which, at the moment, was high. And the president snapped out: "Take it. We'll show a profit on the deal and it will help get our inventory down!"

The day after that house took that order, I talked to that salesman and he told me what his house had done.

"We took the order," the salesman said. "It's the first time I ever knew the house to break its price. I guess we need the business mighty badly. But all the same, I'm sorry about it. Business will pick up again. We could have gotten along without this order. But I can never again feel that the house is really 100 per cent back of its sales policy. Once a house deviates on the matter of price, it is apt to do it again."

The present general business condition is causing many a salesman, many a sales manager and many a head of a company seriously to consider weakening, at least temporarily, and catering to expediency.

Such catering to the needs of the moment need not be confined to any particular period. There are frequently situations to be met when for one reason or another a quick movement of merchandise is advisable —even necessary. Isn't it far safer, under such conditions, to put on a "bargain sale" which all customers may be invited to attend rather than try to make it a confidential matter, limited to a few?

A few years ago, I heard of a manufacturer who found himself suddenly overstocked when a certain large export market collapsed through conditions in that foreign country over which he had no control. He was compelled to get quick action. He did not wish to let his product get out into the hands of just two or three huge buyers who would, in turn, offer it at a cut price and demoralize his regular market. Still he had to have quick action.

What he did was this: He wrote to each of his regu-

(*Continued on page* 22)

Machine Finishing for Hot-Mixed Highway Pavement in California[1]

By C. S. POPE, *Chief Construction Engineer,*
California Division of Highways

THIS paper relates to the use of mechanical means for spreading, raking, and finishing hot asphaltic mixture for highway and street paving.

The information presented herewith was obtained over a working period of about three years, during the construction of some 250 miles of asphaltic concrete surfaced highways and thousands of square yards of city streets.

CHARLES STOCKTON POPE
Chief Construction Engineer, California Division of Highways

The purpose of this paper is not to provide a comparison between the asphaltic type of pavement and any other type, but rather to describe an important advance in improved structure in the asphaltic type and a more economical construction which has been made possible by the introduction of machine finish.

Conclusions

The advantages which have become apparent and the improvement in asphaltic construction which have followed upon the introduction of mechanical spreading and finishing have been summarized as follows:

(1) Removal of limitations on plant capacity, due to former inability to handle large tonnages on narrow highways.

(2) Decrease in unit costs of asphaltic mixture, due to quantity production and quantity handling on the street.

(3) Greater uniformity of structure of the asphaltic paving base and surface.

(4) Decrease in surface roughness to a point where there is now little difference between the best laid asphaltic type and any other type of pavement in this respect.

(5) Production of a uniformly smooth nonskid surface which will be safe in any weather for a number of years.

(6) Elimination of poor workmanship through the substitution of machinery for hand labor on all of the more important phases of the work.

(7) Reduction in rolling due to the particular arrangement of the paving mixture previous to rolling.

(8) Decrease in plant and street costs due to mass production and decrease in general contract costs due to speed of operations as a whole.

History

In this mechanical age, it may seem strange to you as it does to me that contractors were so many years in adopting the use of power operated spreading and raking machines for asphaltic concrete. Similar machines were readily accepted for producing smooth, well compacted concrete pavement, but the practical asphalt paving man always visualized innumerable difficulties which would assail him if he attempted to use similar machines on his work.

Proposals that it was feasible to spread and rake asphaltic mixtures with machines were met with many objections, since proved unsound. These objections impeded the general adoption of mechanical spreading for two or three years in California at least, after it was first suggested.

During 1924 or 1925, spreader boxes for spreading macadam rock came into general use and their success gave rise to our opinion that these boxes might be used to spread asphaltic concrete base, if contractors could be induced to try them. Their use on the first job on which they were tried allowed the contractor to take off a number of shovelers, so he was entirely agreeable to the next experiment which was to attach rakes to the spreader boxes to rake out the mix. This improvement allowed the contractor to take off one or two more men and convinced us that asphalt concrete could probably be raked and spread by machine methods.

Our spreader boxes were not so economical on the

[1] This paper was delivered before the annual convention of the Asphalt Association, held at West Baden, Indiana.

thin 1½-inch surfaces we were then laying in 1926, so we investigated the use of a large drag rake spanning the entire 20-foot width of roadway to be followed by a strike-off screed. These implements were at first drawn by hand and later by horsepower. Both implements operated successfully and gave us a surface smoothness superior to anything we had been able to obtain by hand raking methods, but did not tend to increase plant output.

Through the coöperation of one of the larger road machinery manufacturers, we secured a standard concrete finishing machine and proceeded to remodel it at our own expense and thus completed the first attachments for raking and finishing asphalt concrete by mechanical means.

This machine was furnished on trial by the state to one of our contractors engaged in resurfacing a 10-mile section of highway. The working out of the usual defects which seem inherent in a new machine caused us all more or less concern but in the end the machine got down to work and turned out an excellent job which showed a roughness of about half of what we had been getting by hand raking. The successful use of this machine was followed very shortly by a decrease in our costs of asphalt concrete paving. So much for the early history of the development of the raking and finishing machines.

Objects Sought

The earlier purposes sought in the use of machines for raking and finishing asphaltic concrete pavement were several.

It was desirable to increase the amount of material which could be handled on the road beyond what was possible by hand spreading. Plant capacity could be increased by building larger plants and hauling equipment could be handled on the road, but because of the nature of the material it did not seem possible to place enough shovelers and rakers on a 20-foot road to handle the greatly increased tonnage required for economical work. In other words, the spreading and raking operations constituted the bottle neck of the job.

It was desirable that smoother pavements be laid because of the unfavorable comparison which constantly arose between Portland cement concrete pavements smoothly finished by machine methods and asphaltic pavements still finished by hand raking.

It was desirable that a nonskid surface be constructed which, while smooth, would still afford as safe driving in rainy weather as was claimed for the Portland cement concrete.

It was desirable to incorporate in the pavement

MACHINE FINISHING HOT MIXED PAVEMENT

The picture shows truck backing up to spreader box over a base widened with asphalt concrete and painted with emulsified asphalt. The raking and finishing machine is spreading surface leaving the typical rake marks after rolling. This machine has the sliding type of rake

construction such qualities as would insure a long life and freedom from objectionable waviness.

A considerable mileage of thin Portland cement concrete pavement, usually 15 feet wide and 4 inches in thickness, was constructed on the California highway system between 1912 and 1922. An unusual feature of this pavement was its high crown which averaged about 2¾ inches or about 3 per cent of the half width. This high crown eventually added about one inch additional average thickness for leveling course over the 15-foot width.

Due to the enormous increase in traffic, to faulty foundations, to under-design of the slab and other causes, a considerable mileage of this pavement began to show distress as early as 1916 or 1917 and the state has launched a program of reconstruction or surfacing these pavements to a width of 20 feet.

Highways in especially bad condition or which are subjected to truck traffic or to unfavorable climatic or topographic conditions are resurfaced with Portland cement concrete, while those in better condition or which are located in the valleys or other more favorable locations are surfaced with asphaltic concrete.

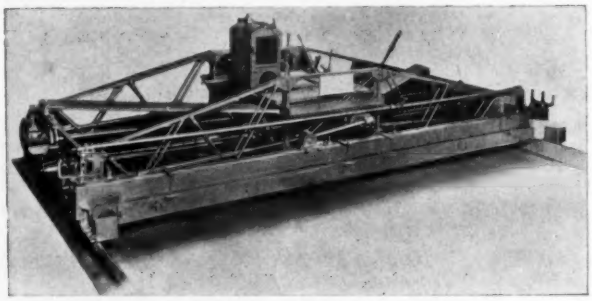
The asphaltic concrete type of asphaltic pavement has been chosen generally in California because of its economy combined with a durability equal to any other asphaltic type, and also from the fact that it presents a nonskid surface for a longer time than other plant-mixed asphaltic surface.

Preparation

In modern resurfacing operations because of the greatly increased output, great care is necessary in planning to insure smooth coordination between the plant, the hauling equipment, and the spreading and rolling operations.

Plant

I will refer briefly to certain plant arrangements which have a bearing on our practice. A plant of considerable capacity is desirable, and common practice in California at the present time has fixed on plants producing from 2,500 to 5,000 pounds per batch as the economical size. Such a plant will turn out up to 65 batches per hour, if properly arranged and average outputs of from 500 to 800 tons per day are not unusual. While our specifications limit output to 65 batches per hour, the number may be increased should our laboratory and field investigations indicate that improved methods introduced by the contractor will produce a satisfactory mix in a shorter mixing cycle.



ASPHALT RAKING AND FINISHING MACHINE
PENDULUM TYPE OF RAKE

We have found it desirable to premix all of our aggregate before it is passed to the proportioning bins and this is accomplished either by mixing in layers at stockpiles or else by means of chutes which deposit layers of coarse and fine aggregate on a belt running under the storage bins and which feed the dryer. Weigh boxes are always placed with their outlets at right angles to the mixing shafts of the pug mill instead of parallel with the shafts, since the latter arrangement has a tendency to defeat complete mixing of the different sizes of aggregate.

Hauling Equipment

Because of the precarious condition of many of our concrete pavements, it is usually required that all hauling be done with pneumatic-tired trucks.

Since the usual load of mixture varies from 5 to 6 tons, the dual type of tire is in common use.

Trucks are usually fitted with convenient coupling devices placed forward of the middle of the truck for ease in attaching the chains by which the spreader boxes are drawn.

Spreader Boxes

Two usual types of spreader boxes are in common use one of which is equipped with skids on which it is dragged forward and the other is supported by means of rollers. Both are equipped with more or less satisfactory gates extending the full width of the back to permit spreading the mixture to the proper thickness. Some difficulty is experienced in making the ribbons of mixture deposited by the spreader boxes lap over each other without rock pockets developing. One of the best methods to secure this result is to cut holes about six or eight inches square in the ends of the spreader box near the front of the box which will allow sufficient average mixture to run out to make the junction of the ribbons satisfactory.

We have found spreader boxes economical and satisfactory whenever a uniform thickness of surface of considerable depth is to be spread. Some contractors claim little saving where a surface less than 3-inch loose is to be spread. In spreading leveling course, contractors have resorted to numerous ingenious methods of spreading the surface of the course parallel with the true surface.

MACHINE FINISHED ASPHALT CONCRETE PAVEMENT

Side Forms and Rails

Since it is now our common practice to require that side forms be left in place, such forms are of wood, usually a commercial, three inches in thickness and as deep as the pavement.

They are supported on hubs at four-foot intervals and are securely staked to prevent lateral movement. We require all forms to be surfaced on both edges. While it is quite possible to spread base or leveling course from the wooden side forms, it is not possible to spread surface with spreading machines as at present designed.

It is necessary to make an allowance for compression and for this purpose it is common practice to lay flat steel rails about three-quarters to seven-eighths of an inch in thickness by 2½ inches to 3 inches in width on top of the wooden side forms to elevate the finishing machine a sufficient distance above the side forms to allow for compaction during rolling. These rails usually have a V-shaped or tongue and groove connection with each other to preserve alignment and are about ten feet in length. Usually three or four sets of rails are sufficient on the average job, as they are taken up and moved ahead as the work progresses. It is usual to nail the rails temporarily to the side forms.

Finishing Machines

Two types of finishing machines are now in use in California both of which will spread, rake, and finish asphalt concrete. Both types of machine are motor-driven and consist essentially of front and rear screed plates set about 10 feet apart, having a motion transverse to the pavement at the same time that the machine advances along the side forms. The raking elements are set in between the screeds and consist of steel pins set in heavy pipe as described elsewhere.

We require not only spreading but also raking and respreading by the rear screed on all of our work and in this respect our practice differs somewhat, I believe, from other localities where spreading only without raking is a usual practice. Since we have not tried our machines on sheet mixtures, I am unable to say from actual experience whether raking of these mixtures is essential with a screed machine, but from a large experience in laying sheet asphalt by hand methods, I would consider raking such surfaces as essential as raking asphalt concrete.

The two types of rakes mentioned, and which I will designate as the pendulum type and the sliding type, represent the different ideas of the manufacturers but they perform similar work.

The rake teeth which consist of steel pins from 8

ASPHALT RAKING AND FINISHING MACHINE

This machine is an early adaption of the raking principle and was afterward converted to the sliding type. (Rake teeth are reversed for clearance)

inches to 14 inches in length and one-half to five-eighths of an inch in diameter are set 6 inches or less apart in two lines of double thickness pipe of 2 inches to 2½ inches nominal diameter. The teeth are adjustable for projection and are fixed in place with set screws. The rake assembly extends the width of the machine, 10, 15, 20, or 30 feet as the case may be. The essential difference in the two types of machine now in use is the method of raking used.

In one machine, the rake teeth swing with a pendulum motion in opposite directions which stirs up the mixture in line with the direction of travel.

In the other machine, the entire rake assembly slides backward and forward between guides, the teeth plowing under and lifting the mixture at each forward stroke, and on the backward stroke assisting slightly perhaps the forward movement of the machine.

Both the pendulum and sliding motions are induced by means of an eccentric connected to a countershaft and operating crank arms which swing the rake's teeth or cause the whole raking element to slide.

The second method has, I think, certain advantages over the first, especially for thin surfaces.

The teeth are set to rake at from 16 to 20 strokes per minute, and have a travel independent of the forward motion of the machine of from 4 to 8 inches. It is not desirable that the rake speed should be too fast nor the stroke too short. The sliding type of rake may have a longer stroke and be slower than the pendulum type.

(*Continued on page* 24)

The Crushed Stone Journal

Official Monthly Publication of the
NATIONAL CRUSHED STONE ASSOCIATION, INC.
Merchandise Building 1735 Fourteenth St., N. W.
WASHINGTON, D. C.

J. R. BOYD, Editor

Cost Accounting Committee Holds First Meeting

IN the belief that there exists throughout the crushed stone industry a real need for uniform cost accounting methods, President Wise, shortly after the Cincinnati Convention, appointed L. R. Cartwright, Vice-President of the Mid-West Rock Products Corporation, Indianapolis, Indiana, as Chairman of a Committee on Uniform Cost Accounting. It was soon realized that to be effective such a committee should be subdivided into two sections, one to cover the West and the other to cover the East and further that its personnel should include those thoroughly familiar with present cost accounting practice in the crushed stone industry. To Mr. Cartwright was delegated the responsibility of forming this committee. Excellent progress has been made, the personnel of the sub-committee for the West having been completed and that for the East is being completed at the present time.

The first meeting of the Western sub-committee was held at Indianapolis on May 8 with the entire committee present as follows:

L. R. Cartwright, Chairman, Mid-West Rock Products Corp., Indianapolis, Ind.
E. A. Pierson, Auditor, Mid-West Rock Products Corp., Indianapolis, Ind.
Louis Schneeberger, Asst. Auditor, Louisville Cement Co., Louisville, Ky.
H. W. Overley, General Auditor, Louisville Cement Co., Louisville, Ky.
J. A. Mosier, Auditor, The France Stone Co., Toledo, Ohio.
H. F. Schmitt, Secretary and Treasurer, Columbia Quarry Co., St. Louis, Mo.
E. J. Tomenendal, Treas., Brownell Improvement Co., Chicago, Illinois.
E. J. Kaufman, Asst. Auditor, The Marble Cliff Quarries Co., Columbus, Ohio.
J. R. Boyd, Secretary, National Crushed Stone Association, Washington, D. C.
J. R. Thoenen, Mining Engineer, U. S. Bureau of Mines, Washington, D. C.

Previous to the meeting, J. R. Thoenen of the U. S. Bureau of Mines had prepared a tentative "Summary of Costs for Stone Quarries" which was presented to the meeting for consideration and in the discussion which ensued (requiring almost the entire day) we believe more real progress was made in the effort to establish uniform cost accounting methods than at any previous time.

As a result of the meeting a tentative "Summary of Costs" was established which will be made available to the Eastern sub-committee when it meets in the near future.

Later in the year there will no doubt be a joint meeting of representatives of the two sub-committees to reconcile such differences of opinion as may exist and to draft a comprehensive report for presentation to the annual convention to be held next January.

The effort to establish uniform cost accounting methods for the crushed stone industry is one which deserves the thoughtful consideration of each and every member of the industry and which we are reluctant to say has not in the past received such support to a degree which has been entirely satisfactory. Few there are engaged in modern business who do not recognize immediately the absolute necessity of having accurate cost figures if their business is to be conducted in an economical way. The manufacturer who does not know his true costs is incapable of intelligently pricing his commodity and consequently falls

an easy prey to the temptation to reduce prices in the face of severe competition, even to the point where they are below cost. We are all only too familiar with the chaotic conditions which inevitably result when such price wars are engaged in.

True costs, obtained in such a way as to be comparable between the various plants throughout the industry, would do much to stabilize conditions and prevent ruinous cut-throat competition. The logical procedure to accomplish this would seem to be to establish for the industry uniform methods of cost accounting.

Largely we feel because of a misconception as to what is meant by uniform cost accounting methods, there seems to have been some reluctance to aggressively undertake the establishment of such a system. Let it be definitely understood that the intention is not to endeavor to bring about uniform costs but to confine our activities to a study of cost methods to develop a uniform method of cost accounting. This distinction has been clearly set forth in a definition of "Uniform Cost Accounting" as given by the Chamber of Commerce of the United States, as follows:

> Uniform cost accounting comprises a set of principles and in some cases of accounting methods which when incorporated in the accounting systems of the individual members in an industry will result in the obtaining of cost figures by the individual members of the industry which will be on a comparable basis. Uniform cost accounting does not mean the preparation of average or standard cost figures for the industry, nor the inclusion in cost of predetermining or fixed elements of cost.

The Association's Committee on Uniform Cost Accounting has a difficult task before it, but one which when completed should prove most beneficial to the crushed stone industry.

We repeat, this committee deserves your full and sympathetic support which we are confident will be whole-heartedly extended.

Edward Balf

It is with deep regret that we announce the passing on May 8, of Edward Balf, president and founder of the Edward Balf Company, Hartford, Connecticut.

Mr. Balf, who was eighty years old at the time of his death, was a pioneer in the crushed stone industry in New England. Since the company's inception he has served continuously as President and General Manager and earned the love and respect of those associated with him.

New England crushed stone producers will keenly feel his loss and our deep and heartfelt sympathy is extended to his family and friends in their bereavement.

British Quarrymen Lose Lives for Lack of Accident Prevention

THE Mines Department of the British Government states that the divisional inspectors of mines have reported during the last four weeks for which full details have been received, eight fatal accidents causing the deaths of eight persons; 24 persons were injured by fatal and non-fatal accidents.

The following are among the fatal accidents which there is reason to believe might have been avoided by a greater regard for "Safety First:—

(1) A workman (who was not employed by the owner of the quarry) was filling sand into a motor wagon at the base when a load of sand fell from the upper part of the sand bed and buried him and he died from asphyxiation. The fall was caused by the face being insufficiently battered. The fact of there having been a heavy shower of rain a few hours previously with probably vibration from trains of coal wagons on a colliery line some 40 yd. away may have been contributory factors.

(2) A joiner was replacing the corrugated sheet roofing of the "cab" of a steam-driven shovel when the feet of the 12 ft. wood ladder which he had erected, and on which he was standing, slipped, and caused him to fall from a height of 8 ft. 9 in.; he died three days later. The only precaution taken to keep the ladder in position was the placing of a small stone at either of the feet and these rested on a wet floor; the ladder was set at an angle of 65 degrees with the horizontal. Had greater care been taken to ensure that the ladder was thoroughly secured or fixed the accident would not have happened. It was daylight at the time, but raining.

(3) While a quarryman was dressing down loose stone after shot-firing he fell a distance of 73 ft. from his working place, which sloped about 45 degrees, and was killed. He had failed to secure himself against falling. A wire rope was hanging over the quarry face near his working place. He was seen using the rope just before the accident occurred. Either he had taken off the rope or he had not properly attached it. —From *The Quarry and Surveyors' and Contractors' Journal*, May, 1930.

Trade Practices and the Law[1]

BY JOHN LORD O'BRIAN
Assistant to the Attorney General of the United States

THE invitation to address you today was coupled with the statement that Trade Associations would like to obtain a better understanding of the attitude of the Department of Justice toward their activities. Every clear-headed lawyer understands the changing conditions which must constantly accompany progress in the world of business. Every experienced lawyer knows how much Trade Associations have contributed and are contributing to the development of a sound public opinion in the special fields of industry. No one understands this better than the law officers of the Department of Justice, and I can assure you that that Department is not in the slightest degree hostile to the proper activities and healthy growth of Trade Associations, the best service I can render you is to make clear the attitude of the Department of Justice and the legal limitations which encompass its activities and affect the exercise of its powers.

The Attorney General of the United States is not and cannot be an arbiter in the field of economic interests. His powers and his duties relate solely to the enforcement of law. It is not within his power to change the legal standards of business conduct as defined by Congress and the Courts, and if you stop to reflect upon this you will not wish him either to have or to attempt to exercise any such power. The conduct of business should be guided by standards of law and not by the discretion or caprice of any official. All of us know only too well that difficulty and often danger arises when officials of Government undertake to regulate by their individual standards of discretion the intricate problems of the business world.

In dealing with the subject of monoply and combination the powers of the Attorney General are clearly defined. He alone is vested with power to enforce the Sherman Act. It is his duty to act when practices unduly restrain or interfere with the free flow of interstate commerce. His powers in respect to the trust laws are limited to this special field of business activity. He has neither the expressed nor the implied power to interfere with or attempt to guide the internal affairs of business organizations or trade associations, nor has he any desire to do this.

The Department of Justice is, therefore, interested only in the acts and conduct of individuals and corporations. It deals with groups of individuals only in those cases where the individuals are alleged to have combined for some illegal purpose. It is not within the power of the Attorney General affirmatively to approve trade rules or practices. A practical reason for not attempting this is that neither he nor any other law officer can accurately forecast what individuals may undertake to do in a particular industry pursuant to trade rules. In short, the Department of Justice is not concerned with "Codes of Ethics" or Codes of "Trade Rules" or "Trade Plans" unless illegal practices result from their operations or unless (as in rare cases) the rules on their face obviously contemplate action which if taken would be unlawful.

The Federal Trade Commission is in a somewhat different case. While it has no jurisdiction to enforce the Sherman Anti-Trust Act it has jurisdiction to investigate unlawful practices and to enforce provisions of the Clayton Act. In the exercise of its jurisdiction to deal with unfair practices the Commission has not confined its activities to investigations and prosecutions but in the desire to aid business has developed the practice of holding conferences. Out of this has come the Federal Trade Practice Conference which, started as an experiment, has now become recognized as a valuable institution. The Department of Justice has no hostility to the Federal Trade Practice Conferences. On the contrary it approves these conferences and believes that within their legitimate field they afford valuable opportunity for education and for constructive progress in industry. It also recognizes that these conferences belong to the province of the Federal Trade Commission with whose activities the Department has not interfered and with whose aims it is in harmony.

Trade Associations are, as you know better than others, the result of similar natural evolution and business necessity. The Courts have long since recognized their legitimate functions and have fully appreciated their powerful influences in American trade and industry. As I have already stated, the law officers of the Department of Justice are well aware of these facts and they have no interest and no point of view

[1] Before joint luncheon between American Trade Association Executives and Washington Trade Association Executives, Mayflower Hotel, Washington, D. C., May 1, 1930.

adverse to the proper activities of trade associations. In fact they have no concern with the affairs of those associations except as individual members through the use of these associations or their rules may adopt practices which lead to violation of the anti-trust laws.

Perhaps it is only reasonable to expect that certain excesses of zeal are bound to occur in the experimentation with business practices which are a feature of the evolution of the trade association. Candor, however compels the statement that here and there such illegal practices do come to light. Fortunately they are not characteristic of the work of the great body of trade associations. Some of these practices are unlawful because discriminatory or because they aim at monopolization of channels of distribution, or for other reasons. But the complaint most often made is that of price fixing and in certain quarters convincing evidence of this practice has been found by the Department of Justice.

For many, many years the fixing of arbitrary prices by the agreement of competitors has been viewed as contrary to sane public policy. The courts have long since declared it to be illegal. Everyone knows that it is illegal. No one can be engaged in this practice without knowing it, and no one needs a lawyer to tell him whether he is in fact fixing prices by means of understandings or aggreements with competitors.

On this as on similar questions the Trade Commission and the Department of Justice are, so far as I know, entirely in harmony. Neither one has ever sanctioned or intended to sanction this practice. There have, nevertheless, been recent instances where this practice of price fixing has been attempted by the misuse of so-called Codes of Ethics or Trade Rules. Fortunately the number engaged in these practices is relatively inconsiderable and their conduct has not been imitated or approved by trade associations generally. In this one respect. at any rate, when individuals violate the law they must not expect to justify or excuse their illegal conduct by the adoption of formal resolutions or trade rules. Where these legal practices exist the Attorney General intends to check them by appropriate legal action. That is his duty. Fairness to the other trade associations, and justice to other business interests as well as to the public generally require that this duty be firmly and impartially performed.

But in all this there is not cause for anxiety or uncertainty in the business world. The number who take chances are relatively few, and those who take chances should not complain of the consequences. You will agree that no legal proceedings aimed at price-fixing should give the slightest concern to the business world in general and you need have no fear that any conflict of interest exists between the Trade Commission and the Department of Justice. The Federal Trade Commission as well as the Attorney General and his staff desire sane administration of law as well as stability in business conditions. Surely you have the same desire.

I have endeavored to make clear to you the attitude of the Attorney General and at the same time to point out the very distinct limitations which encompass his official activities. With this frank statement to you, we feel that we have a right to expect active cooperation from you. We ask that your numerous associations use their powerful influence to eliminate these business practices which result in price-fixing by agreement and other practices which lead to illegality. The Anti-Trust laws are primarily aimed to protect the economic opportunity of the individual and to promote steadily rising standards of fairness and justice. All of us believe this and surely both as lawyers and as business men we ought to work together to realize this purpose.

No Matter How Much You Need That Order Stick to Your Price

(*Continued from page* 13)

lar customers and said: "I have so and so many of these articles I must move in a hurry. To move them quickly, I am cutting the price on this lot exactly 25 per cent. And I am allotting them to all my regular customers in proportion to their purchases so far this year, on the basis of one gross of this bargain lot for each ten gross they have purchased. You are therefore entitled to so and so many gross at the regular price less 25 per cent. This offer holds good for ten days only."

Fair and Above-Board

The plan moved the excess stock of merchandise. It did it in a fair, above-board manner and there was no flooding of the market in any particular locality.

No purchasing agent who has once broken a firm's price in the slightest ever feels sure thereafter that he is getting the lowest price. Invariably, he will stand off and haggle and trade and bargain. When he is finally ready to buy, he will offer the salesman an order with an additional cut in price tacked on. He figures this way: "They are now asking $1 a dozen. They've come down from $1.20. They've come down that far, they'll probably come down to 95 cents. I'll offer that anyway. I've got nothing to lose—everything to gain—they'll probably take it."

A house which drops its price several times is apt to drop a little more to clinch the order. Hours, often days, of a salesman's time are wasted and, in the long run, the merchandise is usually finally bought at a lower price than was necessary to get the order.

But when there is no definite rock bottom to which the salesman can adhere, he is as much at sea as the buyer himself. It is highly unsatisfactory selling for all concerned.

On top of that, when the salesman is given a price list, only to be permitted a little later to break it with a confidential concession, the salesman himself never does know how much lower the house will go. He knows that the house is not treating fairly and honestly the buyer who does not ask for something extra.

He says to himself: "I wonder how much the house is giving to its other men to help them close big orders." It is a perfectly natural stand to take.

Once he takes that stand, the moment a big order comes in sight, he is going to fortify himself with a price concession. It is amazing the number of reasons

for a price concession which the salesman can conceive once he knows the house will give a concession under pressure.

As one purchasing agent said to me: "No experienced purchasing agent is puzzled long on this matter of price. Talk with a salesman for a few minutes and you ferret out quickly whether there is an inside price or not. Personally, I'd rather deal with a house which will not deviate. Then I know just where I stand. But when I do sense that there is a concession to be had under pressure, then I owe it to my house to bring that pressure to bear. I've got to get it out of that salesman."

But the most unfair thing to the salesman was explained by one of the buying profession as follows: "A salesman who once starts to sell by giving concessions is no longer selling his product. He unconciously drifts into the practice of talking price and price concessions. He will soon tell you honestly that he can't sell without now and then making a concession. And he is not only perfectly sincere in his statement but more than 50 per cent correct. His real effectiveness as a salesman is far gone.

"Only a severe and drastic move will bring such a man back into line—back for his own good."

It is often a hard thing to pass up a fine account—to pass up definitely an order running into thousands of dollars when a little concession would bring it in at a good profit to the house. But to the salesman who has worked under both plans, there is definite assurance that when a house once makes even a slight concession, it is absolutely and inevitably starting something it can't finish.

If there is such a thing as a "dope habit" in business, it is the practice of giving a private concession, or secret rebate, or confidential allowance. It is vicious, demoralizing and humiliating. If we are free from it, by all means let's stay out, even at the cost of the biggest order that ever came along. If we're in it, let's drop it in a hurry, while we may—if we can.

Machine Finishing for Hot-Mixed Highway Pavement in California

(*Continued from page* 17)

Essential features of the raking are the lifting of the coarser aggregate to the surface of the mixture and the formation of compression ridges. The coarse aggregate being lifted to the surface allows it to be reimbedded in the immediate wearing surface by rolling and thus forms a nonskid surface. The compression ridges between the furrows left by the rake teeth have a tendency to assist compression without distortion or travel in the mixture since the ridges are flattened out sidewise by the roller instead of being driven ahead by it.

Paving Operations

The paving operations in the construction of base and surface are as follows:

Paving mixture heated to approximately 280° F. is brought to the road in pneumatic-tired trucks of 5- to 6-ton capacity.

If a leveling course is to be laid on old concrete, a paint coat of emulsified asphalt is first applied to the concrete base.

The trucks are backed up to spreader boxes and are attached to them by means of a quick detachable chain hitch.

The mixture is roughly spread about 2 inches thicker than it will be left by the finishing machine and is at once spread to a uniform thickness using the screeds of the finishing machines only as a usual thing. Some operators use the rakes also as they think they assist compression. Rolling is begun as soon as the machines have spread a sufficient amount of material. Practically no handwork is required on the base mixture.

Base mixture is usually carried forward for such a distance as to allow a full day's run on surface, or for even a longer distance so that it will not be necessary to make so many shifts of the finishing machine. On one large job at present under construction, two finishing machines are in use, one on base and one on surface, which obviates the necessity of moving either one back on the job. Machines are usually moved off the pavement at night to permit its use by through traffic.

Surface operations follow closely on the methods used in constructing base with a number of additional operations, however. It is first necessary to lay steel rails three-quarters to seven-eighths of an inch thick on top of the side forms, as hereinbefore described, to give the screeds the proper elevation above the side forms to allow for compression in rolling.

The screeds, which are cut at the center, are adjusted to the correct crown by means of hand wheels. The rake teeth are lowered into the mixture and in the sliding type are set at an angle of about 45 degrees.

During operation, it is desirable to carry a wave of mixture about half the height of the front screed in front of that screed and a smaller wave of mixture in front of the rear screed.

During the operation of the machine, the rakes are forming ridges and furrows longitudinal with the road and the rear screed is just knocking the top off the ridges, leaving coarse aggregate exposed for rolling. The machines are usually equipped for four wheel drive and will operate at a forward speed of up to 10 feet per minute.

Rolling

Rolling is done with 10-ton macadam rollers for the first compaction followed by 6- to 8-ton tandem rollers for final smoothing.

Following the first rolling of the surface, our customary practice is to scatter asphalt coated stone chips, passing three-eighths inch and retained on one-quarter inch over the surface to fill any small voids which may be left in the surface and to provide additional assurance that the surface will be of uniform nonskid texture. Rolling is then continued until no more compaction is possible and the surface is as smooth as it can be made.

Smoothness

Surface smoothness is checked during construction by several different methods devised by ingenious resident engineers. The simplest method is, of course, to use a 10-foot straightedge, but as this requires a good deal of stooping, other means have been devised.

One automatic device consists of a straightedge on three wheels so arranged that a rise or fall of the central wheel of more than one-quarter inch rings a bell; another has a similar bell arrangement but the straightedge consists of two sled runners, while another is a weighted sled which scores the high points as it is dragged after the roller.

The official record of roughness, however, is recorded on a vialog or roughometer attached to an automobile operating at twenty miles per hour. This machine is left constantly calibrated by checking its operation over two or three standard sections of pave-

ment which have been run over many times and on which the roughness has been accurately determined.

The following tabulation indicates the average smoothness we have obtained on some 200 miles of asphalt concrete pavement laid in the last five years:

Year	Miles laid	Roughness index	Remarks
1924	23.84	30.1	Hand finish
1925	24.11	33.2	Hand finish
1926	49.34	24.1	Hand finish
1927	35.35	25.2-14.6	Machine finish begun
1928	60.81	30.9-14.7	

We have been able to reduce the roughness to as low as eight units on some especially well finished jobs without sacrifice of the nonskid feature.

We find that roughness increases with each year a pavement is in use. One of our asphalt pavements laid three years ago with a roughness index of 11 now has a roughness index of 14.

Output

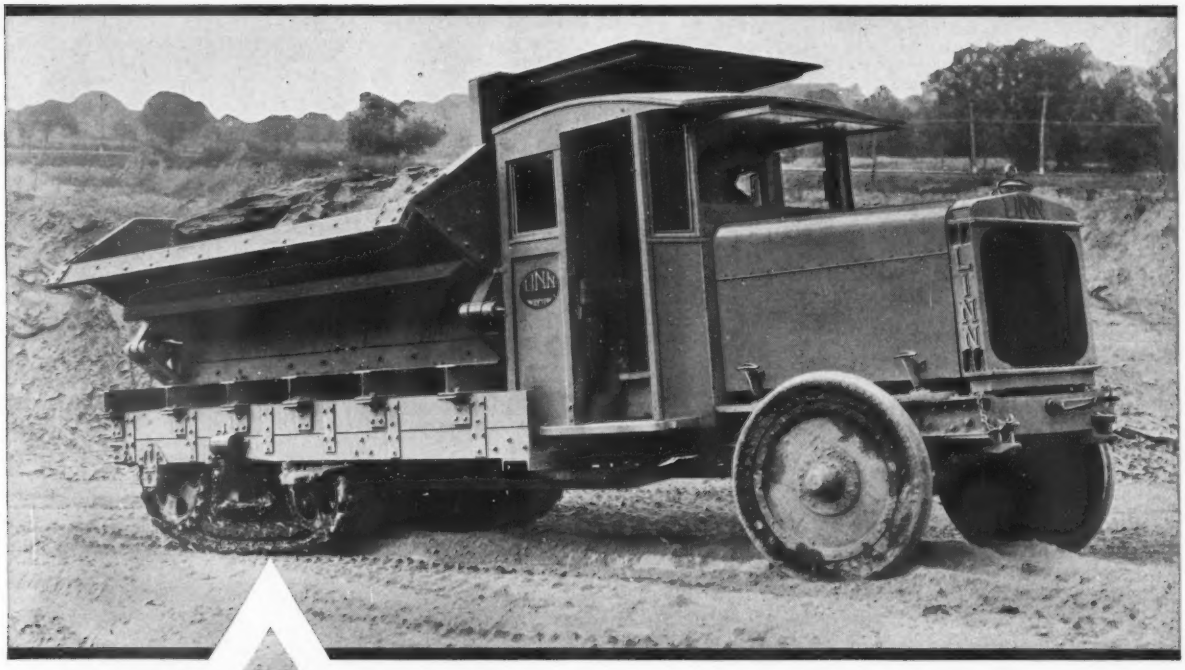
The introduction of finishing machines has, as stated before, greatly increased the average tonnage output of paving plants, and has also decreased the cost per ton as shown in the following tabulation:

Year	Tonnage Max.	Per 8-hr. day average	Average cost per ton
1924	244	194	$7.27
1925	319	214	6.43
1926	388	333	5.13
1927	366	352	5.68
1928	574	404	4.89

Naturally, this increase in output has required larger plants, and where a 1,500- or 2,000-pound batch box was the usual size in 1924, we are now using batch boxes up to 5,000 pounds capacity with the cost of the plant in proportion.

In conclusion, I wish to predict that the more extensive use of machinery in the construction of asphaltic pavements has opened a new era for this material and that with the growth of knowledge as to the economic and engineering considerations which should govern the selection of pavement types, the use of asphaltic pavements in their proper locations will reach proportions sufficient to satisfy its most ardent advocates without detracting from the merits and usability of other types of pavement in their proper environment.

LINN... THE IDEAL UNIT FOR QUARRY OPERATIONS



From the quarry to the crusher—up grade—the LINN easily transports heavy loads for the Hercules Cement Co., at Stockertown, Pa.

HAULS
PAY LOAD
AS IT LAYS
ITS OWN ROAD

With ten tons of pay load on its strong chassis . . . with patented flexible traction to grip and pull on uneven ground surfaces . . . with giant power to move easily out of different situations . . . the LINN makes truly great performance records in all types of quarry hauling.

In keeping with the trend toward mobility of quarry equipment, the LINN follows the shovels to any part of the quarry for its load, and transports that load under severe conditions of ground and grade. It proves itself a highly efficient and economical hauling unit.

Only the LINN lays its own road as it carries pay load. It steers and operates like a motor truck. It makes money for its owner, despite "tough going" and bad weather. Performance data on LINN tractors in a wide variety of industries is yours for the asking.

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Division of LaFRANCE-REPUBLIC Corporation

Manufacturers of American La France Trucks, Linn Tractors, Republic Trucks

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105 direct distributors located throughout the United States and 49 distributors located in 30 foreign countries

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LA FRANCE REPUBLIC LINN TRACTORS

ATLAS BLASTING MACHINE

1 to 50 SHOT CAPACITY

THE purpose of a Blasting Machine is to convert muscular energy into electrical power that may be used to fire a series of Electric Blasting Caps . . . . . Ten years' experience has assured us that the fundamentals of design of the Atlas No. 3 Blasting Machine are correct. Refinements in design have been made from time to time, thereby increasing the efficiency and durability of this machine, but no radical changes have been made.

As a general rule, factors other than the capacity of the blasting machine limit the number of Electric Blasting Caps that may be successfully fired in series. Under ideal conditions, which seldom ever exist in the field, the Atlas No. 3 Blasting Machine has consistently fired one hundred and fifty Atlas 30-ft. Copper Wire Electric Blasting Caps in a single series. However, we prefer to be conservative and rate this machine at fifty Electric Blasting Caps of the same character wire and length in single series.

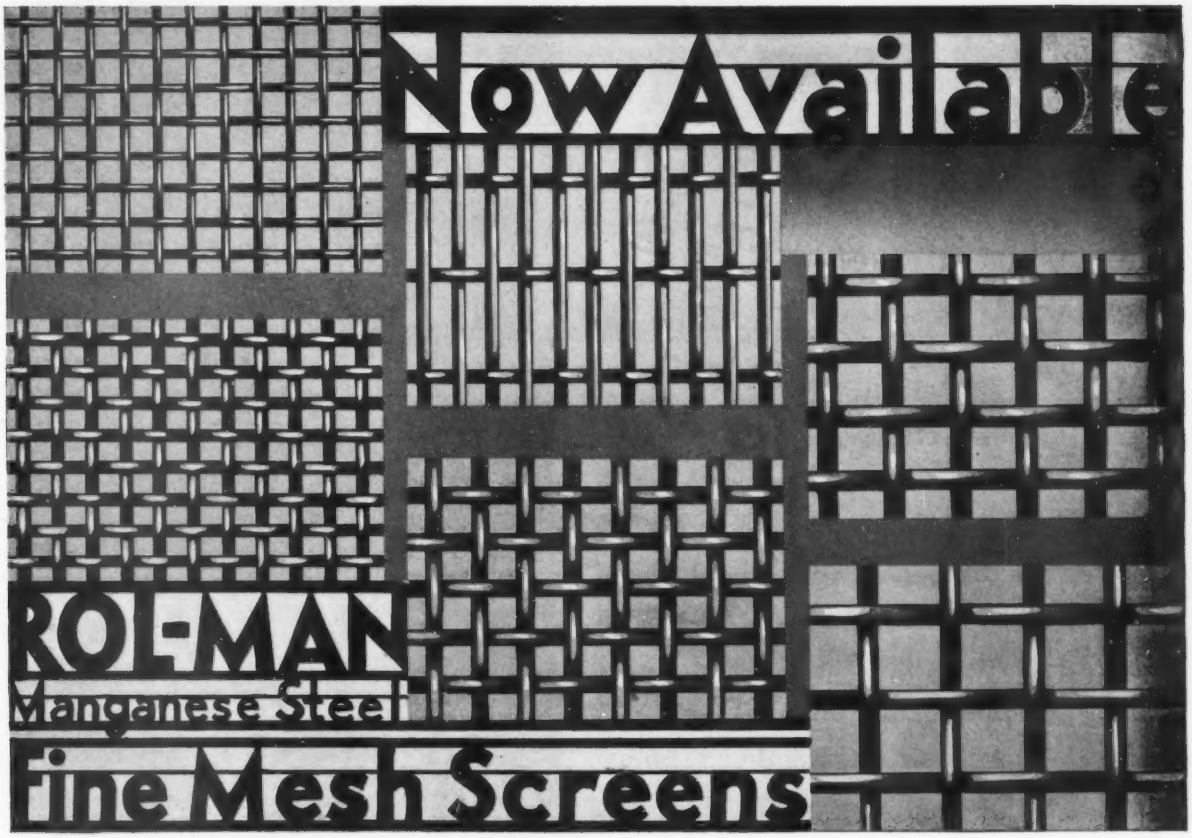
Larger, heavier, and more expensive blasting machines can be designed than the Atlas No. 3, but we are satisfied, through the experience we have gained, that a more durable and a more dependable machine than the Atlas No. 3 cannot be obtained.

ATLAS POWDER COMPANY

WILMINGTON, DELAWARE

Branch Offices:
Allentown, Pa.; Boston, Mass.; Charleston, W.Va.; Chicago, Ill.; Houghton, Mich.; Joplin, Mo.; Kansas City, Mo.; Knoxville, Tenn.; McAlester, Okla.; New Orleans, La.; New York, N.Y.; Norristown, Pa.; Philadelphia, Pa.; Pittsburg, Kansas; Pittsburgh, Pa.; Pottsville, Pa.; St. Louis, Mo.; Wilkes-Barre, Pa.

ATLAS EXPLOSIVES



Now there is available a screen cloth for economically grading fine, abrasive materials—a screen cloth that greatly reduces maintenance and replacement because it has 8 to 10 times the resistance to wear and 2½ times the strength and toughness of ordinary wire screens.

This new screen cloth is the result of over eight years of specializing in the manufacture of rolled and forged manganese steel products. It is made of drawn manganese-steel wire, and is woven with a double-crimp type of mesh.

Maintains a Live Screening Surface---Remarkable Resistance to Wear

The unusual strength of the drawn manganese-steel wire gives an exceptionally live and resilient screening surface that produces highly efficient and thorough screening action. Extended tests under actual working conditions show that the resiliency of this surface is maintained throughout the life of the screen. The new cloth does not become flabby, and "dead spots" do not develop.

It has the remarkable wear-resisting qualities and long life possessed by ROL-MAN double-lock mesh-woven manganese-steel screens, which are widely known throughout the crushed stone, sand and gravel, slag, coke, mining and allied industries for their economy and efficiency on heavy-duty revolving and vibrating equipment.

2 to 16-Mesh---Square or Rectangular Openings---Furnished in Rolls or Cut to Size

The new fine-mesh cloth is available in sizes from 2-mesh down to 16-mesh, with square or rectangular openings, and in desired wire diameters. It can be furnished in rolls 50 feet and longer, and 24, 36, 48 or 52 inches wide, or can be cut to order in practically any specified widths and lengths. Send an outline of your requirements for quotations, samples and complete information.

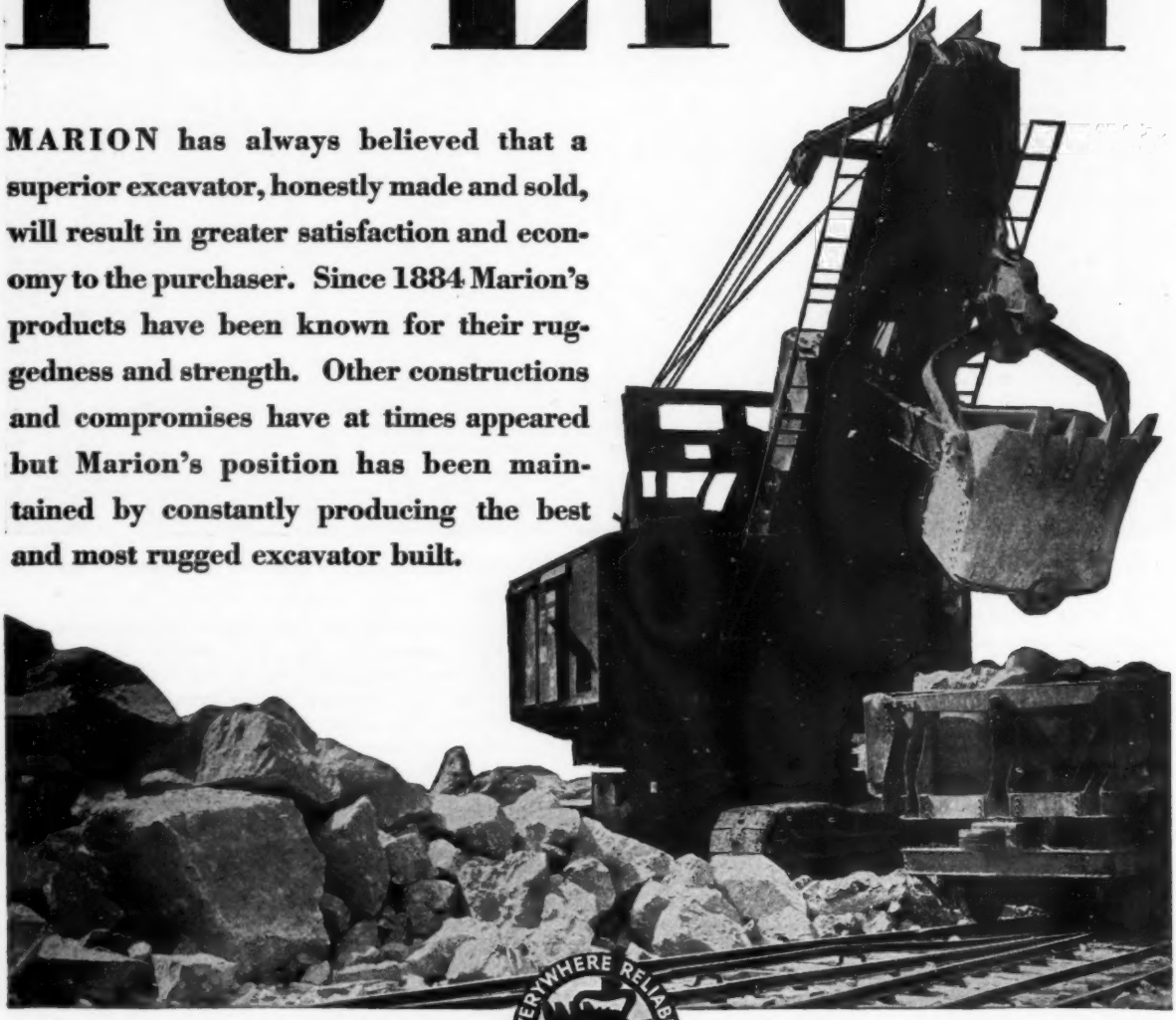
ROL-MAN
A TRUE
MANGANESE STEEL

MANGANESE STEEL FORGE COMPANY
Manufacturers of
ROL-MAN ROLLED AND FORGED MANGANESE-STEEL PRODUCTS
Richmond Street and Erie Avenue, Philadelphia, Pa.

NEW YORK 30 Church St. | PITTSBURGH Clark Bldg. | DETROIT Lexington Bldg. | CHICAGO Builders Bldg. | BOSTON 1 Parker St.

50-YEAR POLICY

MARION has always believed that a superior excavator, honestly made and sold, will result in greater satisfaction and economy to the purchaser. Since 1884 Marion's products have been known for their ruggedness and strength. Other constructions and compromises have at times appeared but Marion's position has been maintained by constantly producing the best and most rugged excavator built.



Come To Shovel Headquarters

THE MARION STEAM SHOVEL COMPANY

Shovels, Draglines, Cranes, 1 yd. to 20 yds.

MARION, OHIO, U.S.A.

Representatives in the Principal Cities of the World

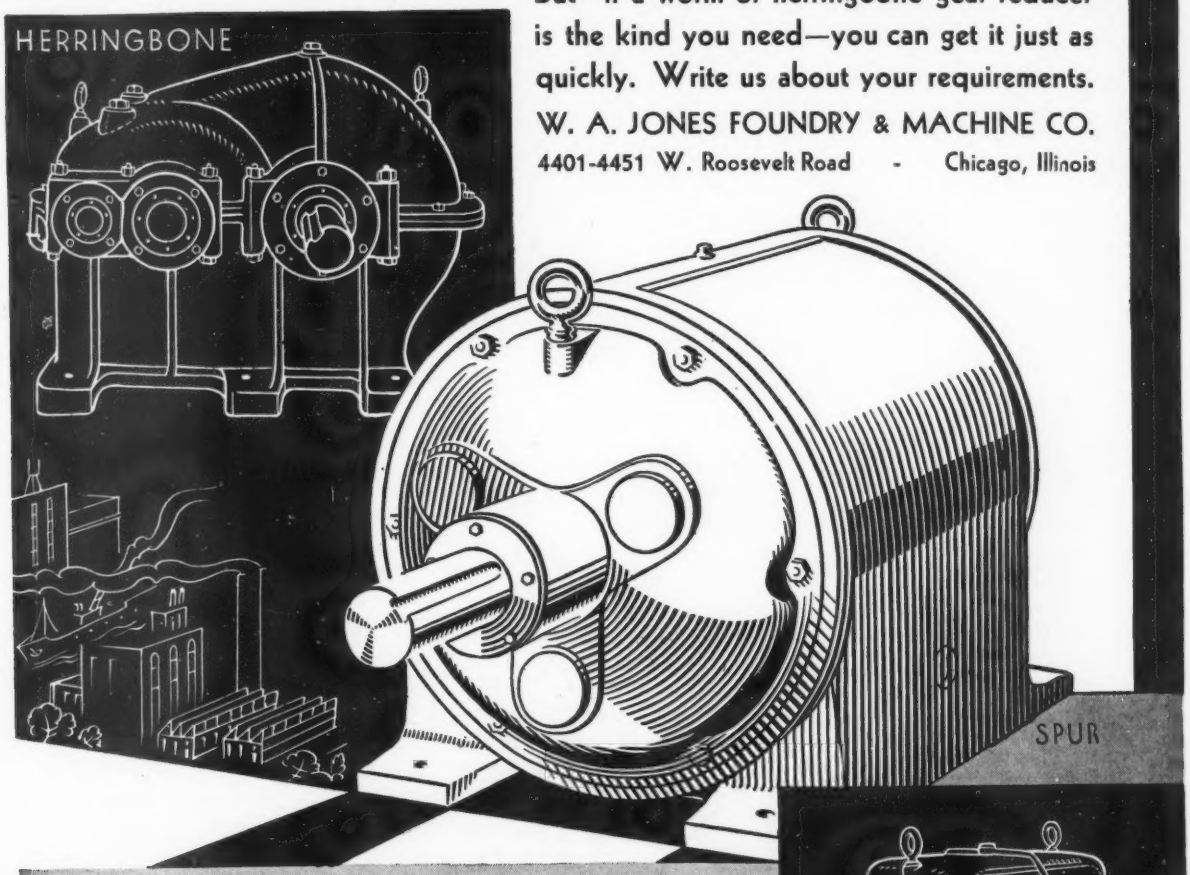
PERFORMANCE

When you install a Jones Spur Gear Speed Reducer—a simple, quick and inexpensive job—you put to work a machine that needs no coddling. It will stand the grind for many years with no attention except infrequent refilling of the oil chamber. The gears are extra strong, accurately cut, perfectly meshed, and fully protected by a dust-proof housing. Saves space. Prevents accidents. Conservatively rated to stand heavier than normal loads when necessary. More than 2,000 standard ratios carried in stock.

But—if a worm or herringbone gear reducer is the kind you need—you can get it just as quickly. Write us about your requirements.

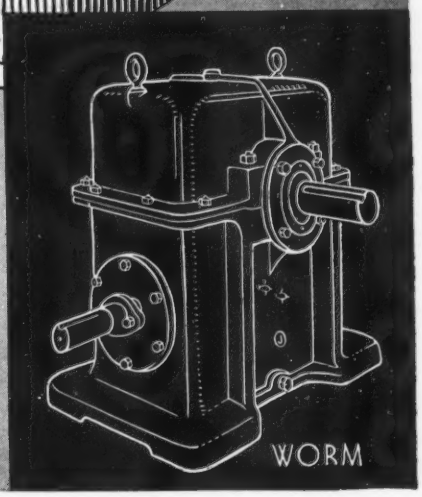
W. A. JONES FOUNDRY & MACHINE CO.

4401-4451 W. Roosevelt Road - Chicago, Illinois



Jones

SPUR-WORM-HERRINGBONE REDUCERS



» CHIPS «

There is big money in Wall Street for any one who knows how to play the market, and Beethoven's sonatas are on any piano if you just happen to hit the right notes.—*Kay Features.*

Couldn't Wait Forever

A road contractor ordered a carload of material from his jobber. The jobber wired him: "Cannot ship your order until last consignment is paid for."

The contractor wired back: "Unable to wait so long. Cancel the order."—*Florida Highways.*

Presence of Mind

The Judge: "This lady says you tried to speak to her at the station."

Salesman: "It was a mistake. I was looking for my friend's sister, whom I had never seen before, but who's been described to me as a handsome blonde with classic features, fine complexion, perfect figure, beautifully dressed and ———"

The Witness: "I don't care to prosecute the gentleman. Anyone might have made the same mistake."

—*Exchange*

"I want to be procrastinated at de nex' corner," said the negro passenger.

"You want to be what?" demanded the conductor.

"Don't lose your temper. I had to look in de dictionary mys'f befo' I found out dat 'procrastinate' means 'put off' "—*Exchange.*

A live wire salesman rushed up to the home of a doctor in a small village about 3 a. m. and asked him to come at once to a distant town.

The doctor cranked his flivver and they drove furiously to their destination.

Upon their arrival the salesman asked, "How much is your fee, doctor?"

"Three dollars," said the physician in surprise.

"Here you are," said the salesman, handing over the money; "the blamed garage keeper wanted $15 to drive me over when I missed my train."—*Maine Motorist.*

Cause and Effect

"I heard the most perfectly darling radio program last night," Miss Sparker gushed.

"Yes, wasn't it wonderful?" agreed her very dearest girl friend. "I didn't have a date either."—*Arizona Highways.*

"Did you give the man a third degree?" asked the police officer.

"Yes. We browbeat and badgered him with every question we could think of."

"What did he do?"

"He dozed off and merely said, now and then. 'Yes, my dear, you are perfectly right.' "—*Midland Daily Tribune.*

Mother: "Why don't you wear that beautiful underwear you got for Christmas?"

Daughter: "Oh, I'm saving that for a windy day."

—*Williams Purple Cow*

"I hear Jones fell down on his pharmacy examination."

"Yes—he got mixed up on the difference between a club and a Western sandwich."—*American Legion Monthly.*

A scientific society announces that death theoretically is not inevitable. This ranks in importance beside the other great truth that the pedestrian has the right of way.—*Detroit News.*

The Delighted Mrs. Dash

Mrs. Dash wished to show kindness to Captain Blank, so sent him this invitation:

"Mrs. Dash requests the pleasure of Captain Blank's company at a reception on Friday evening."

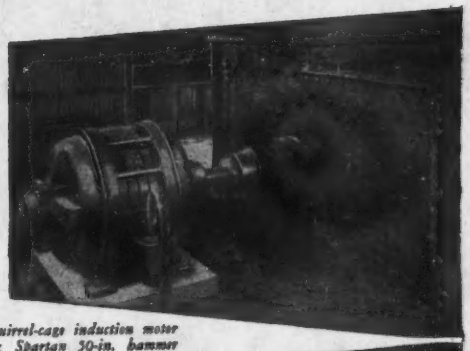
A prompt reply came:

"With the exception of three men, who, unfortunately, are suffering from measles, Captain Blank's company accepts your kind invitation, and will come with pleasure to your reception on Friday evening."

Fyr-Fyter News

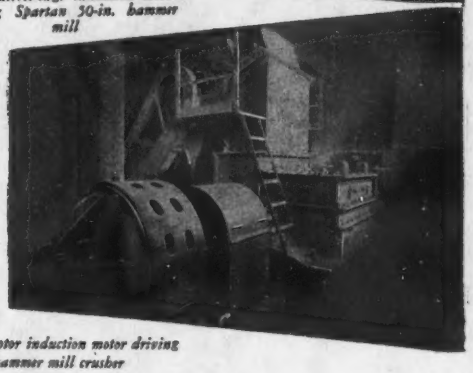
Which Motor for Your Crusher

G-E 350-hp. Super Synchronous motor driving Polysius swing-hammer crusher



G-E squirrel-cage induction motor driving Spartan 50-in. hammer mill

G-E synchronous motors coupled to Raymond coal pulverizers



G-E 400-hp. wound-rotor induction motor driving Pennsylvania hammer mill crusher

G-E engineers call your attention to four specific motors for crusher drives:

Squirrel-cage induction. Recommended where the flywheel effect of the crusher is such that proper starting can be accomplished without over-motoring. The induction-motor characteristic, with slip proportional to load, allows the flywheel to absorb peak loads, reducing the maximum power demand. It is the simplest possible drive.

Wound-rotor induction. Because of its well-known starting ability, it is capable of accelerating heavy loads without excessive current demands. It also takes advantage of flywheel effect in minimizing load peaks.

Synchronous. Because of its high efficiency over a wide load range and its inherent advantage of power-factor improvement.

Super Synchronous. Because in addition to the advantages of the straight synchronous motor, it is synchronized before the mechanical load is started; therefore any part of its high pull-out torque can be applied in suitably varying degrees to starting and accelerating operations.

General Electric manufactures these motors in a wide range of sizes and speeds to meet crushing-machinery requirements. G-E engineering recommendations as to a definite crusher drive are given after a thorough study of your crusher operating conditions. Ask the rock products specialist in the nearest G-E office to consider your power and drive requirements with you. He will gladly coöperate.

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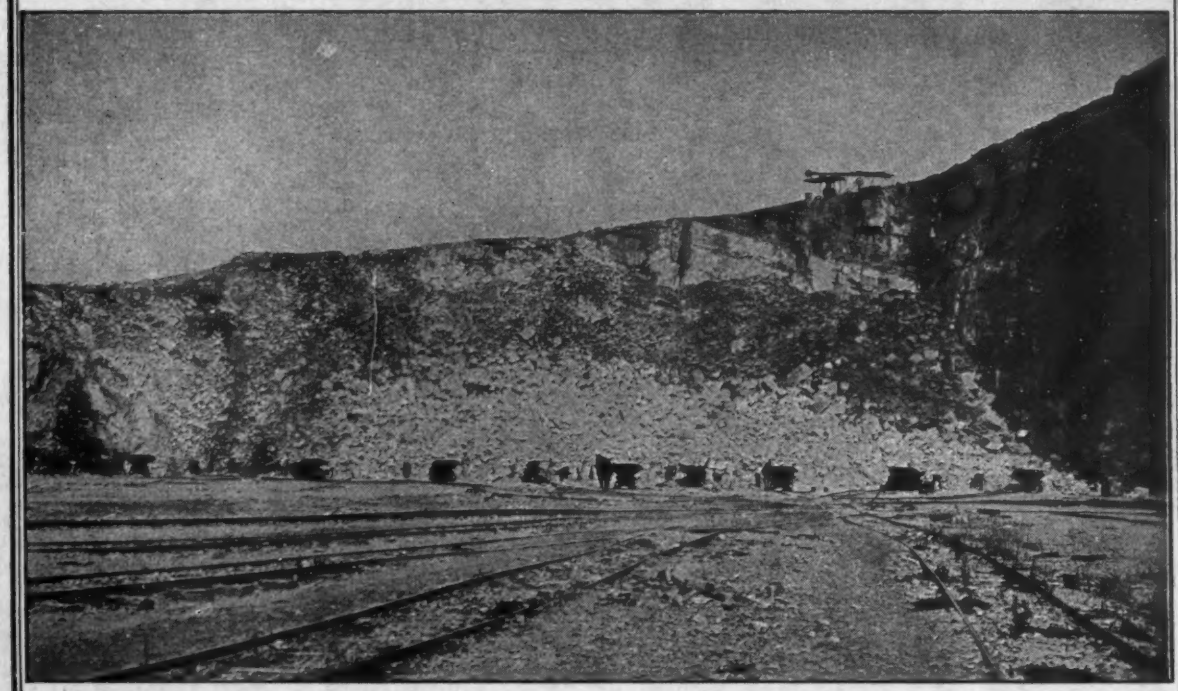
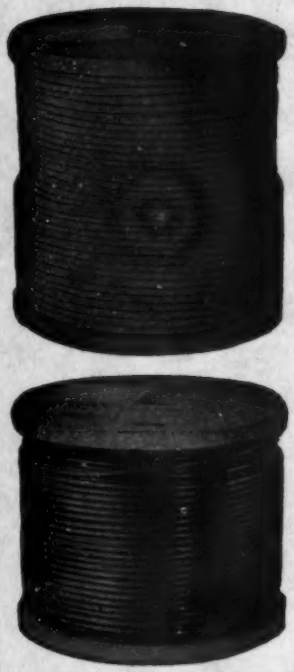
GENERAL ELECTRIC

SALES AND ENGINEERING SERVICE IN PRINCIPAL CITIES





CORDEAU Helps Improve the Fragmentation

CORDEAU, by speeding up the rate of detonation of the explosive charges in a blast, adds materially to the shattering effect of the explosive no matter whether it is a high grade dynamite or the slower blasting powders. Rock well broken, toe kicked out, little secondary blasting, and crushing units well supplied with rock mean good operating conditions and consequent profit for the quarry operator.

CORDEAU
DETONATING FUSE
BICKFORD

THE ENSIGN-BICKFORD CO.

SIMSBURY - CONNECTICUT